GEOMORPHOLOGY

Physiographic region and Geology

The Moreau basin lies in the physiographic province of the United States known as the Interior Highlands. It is part of the northern Salem Plateau, a subdivision of the Ozark Plateau (Figure nd). This landform is characterized by rolling upland topography with local relief of 100-200 feet along major drainage divides (MDNR 1986). Gently sloping praire is evident near Tipton, Latham and High Point (USDA 1964). In areas, rugged hills with deeply carved river valleys can be found. The highest elevation (1100 feet) in the watershed is located along the western border of the basin near Versailles. Water flows toward the east and empties into the Missouri River at an elevation of 523 feet. At one time geologists believe the Moreau River may have emptied into the Osage River near Osage City rather than flowing directly into the Missouri River. The theory is that the Moreau shortened itself by meandering too close to the Missouri River where it became captured (Beveridge 1978).

The predominant rock type includes Ordovician age cherty dolomite, thin beds of shale, and minor deposits of sandstone (Figure ge). The surface contains a stony red clay residuum of the Jefferson City-Cotter formation and some pockets of loess on the tops of high ground (Figure gs) (MDNR 1984). Penetration of water to the subsurface is poor so most water runs off to streams and stream base flows are poorly sustained (MDNR 1984). Minor deposits of lead, iron, germanium, zinc, coal and barite are found in basin counties (USFS 2001). Mining was especially active in Moniteau county near California, Tipton, and High Point in the early 1870's (Campbell's Gazetteer of Missouri 1874). These mines are now closed and current mining efforts are directed at sand and gravel, and limestone.

There are two springs, Steenbargen (SE SW 25, R14W, T43N) and Strobel (SW SW 35, R14W, T44N), located near Russellville in Cole county. Neither spring has significant discharge (Vineyard and Feder 1974).

Soils

The soils of the basin are classified as Ozark Border. The upland plateau is characterized by narrow ridgetops and valleys. Thin loess deposits occur on the ridgetops. Some soils contain fragipans, a loamy or sandy subsurface horizon of low organic content that can form a cement-like layer that impedes water and the growth of roots. Steep slopes contain deep cherty clayey reddish colored soils over dolomite or limestone. Sandy, loamy and gravelly alluvial soils are in the bottom lands. The predominant soil series are **Seymour-Glensted-Creldon-Eldon** ("deep, nearly level to steep, poorly drained to well drained, clayey and loamy and cherty upland soils") derived from loess, limestone, sandstone and shale, and **Union-Goss-Gasconade-Peridge** ("deep and shallow, nearly level to very steep, moderately well drained to excessively drained, loamy and clayey upland soils") derived from loess and limestone (Allgood and Persinger 1979).

These soils support cultivation of corn, soybeans, grain sorghum and hay crops (Allgood and Persinger 1979).

In the 1997 National Resource Inventory, soil erosion losses for lands in the larger 8-digit hydrologic unit (10300102), which includes the Moreau subbasin, were estimated for cropland, pastureland, and non-cultivated cropland. These erosion rates were estimated at 5.619, 1.322, and 0.651 tons of soil per acre annually, respectively, for each land type (Barney 2002, *personal communication*).

Watershed Area

The watershed or drainage area of the Moreau River is 584 square miles. It is located in the southern portion of the Missouri River mainstem-Glasgow to Hermann 8-digit hydrologic unit (10300102)(Figure wa). This watershed is further divided into three hydrologic units: the North Moreau (10300102200), the South Moreau (10300102210), and the mainstem Moreau (10300102220) (Figure wa). Interestingly, the North Moreau hydrologic unit only includes the North Moreau watershed upstream from Burris Fork. The lower portion is included in the Moreau hydrologic unit. Therefore the watershed areas of these two hydrologic units do not equal the watershed areas for these subbasins (Table 1).

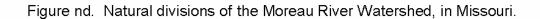
The watershed areas of the three major subbasins are: South Moreau Creek 174 square miles, North Moreau Creek 347 square miles, and mainstem Moreau River 63 square miles (Table 1). The largest proportion of the watershed (59%) lies in the North Moreau subbasin.

Stream Order

Stream ordination is a method used to describe the branching geomorphologic nature of streams. A 1st order stream is unbranched. A 2nd order stream is formed when two 1st order streams join. A higher ordination can only be formed when two streams of the same order join. In this manner, 71 streams, 3rd order or greater, were identified, ordered, and measured using USGS 7.5 minute topographic maps (Appendix 1). They provide a total of 424 miles of stream frontage. The highest order streams are: mainstem Moreau river and South Moreau Creek, 6th order; and North Moreau Creek, Brush Creek and Burris Fork, 5th order.

Stream Gradient

On the mainstem Moreau, the river drops an average 1.6 feet per mile. The 5th order and larger reaches of North (first 47 miles) and South Moreau (first 29 miles) creeks drop 3.6 ft/mi and 6.6 ft/mi, respectively (<u>Figure sg</u>). Additional gradient information for other streams in this basin can be obtained from the Missouri Department of Conservation Central Region office in Columbia (Address: 1907 Hillcrest Drive, Columbia, MO 65201; phone: 573/ 884-6861).



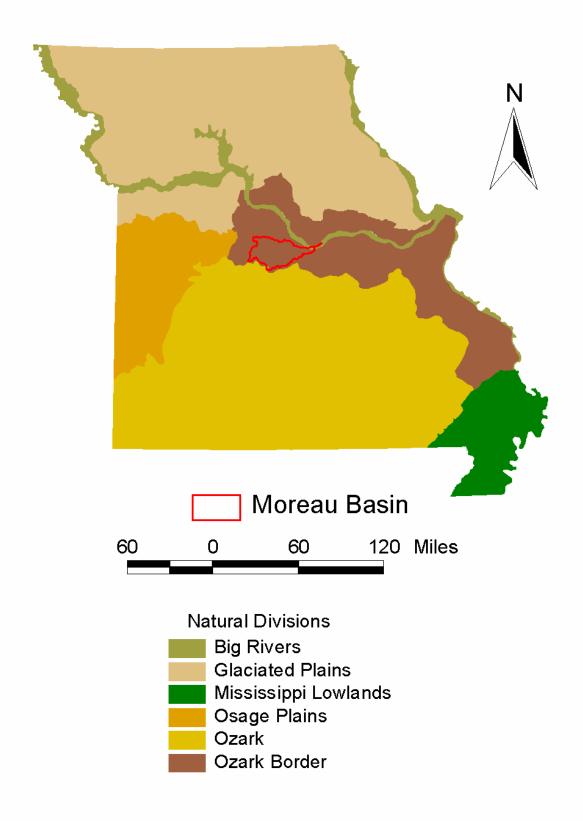


Figure ge. Bed geolgoy in the Moreau River watershed.

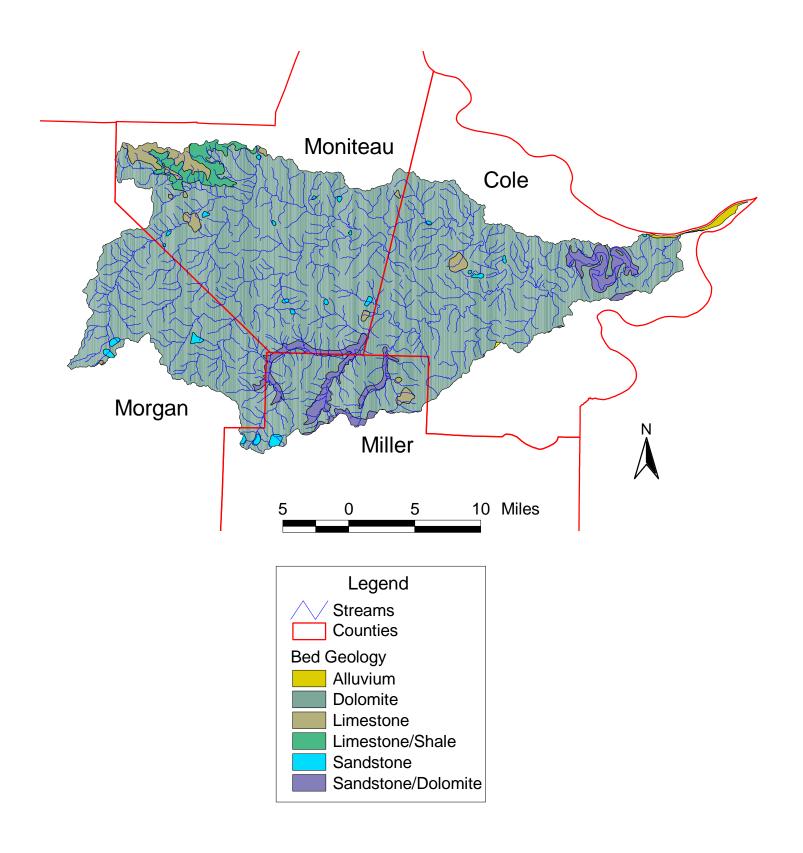
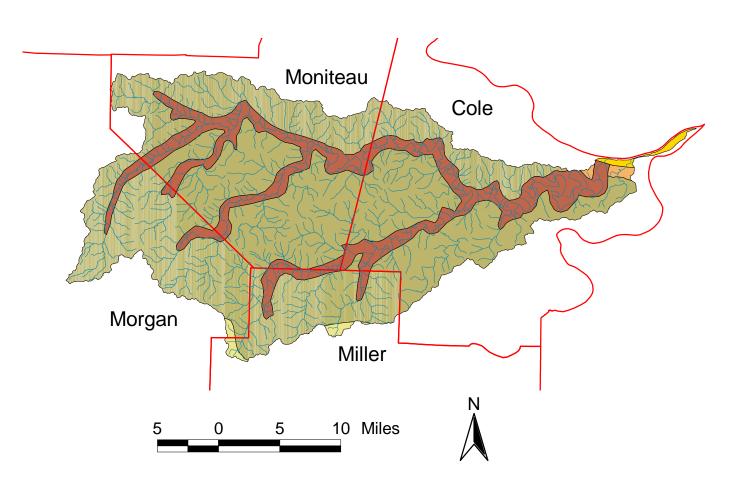
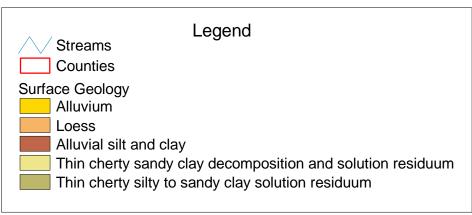


Figure gs. Surface geology of the Moreau River watershed.





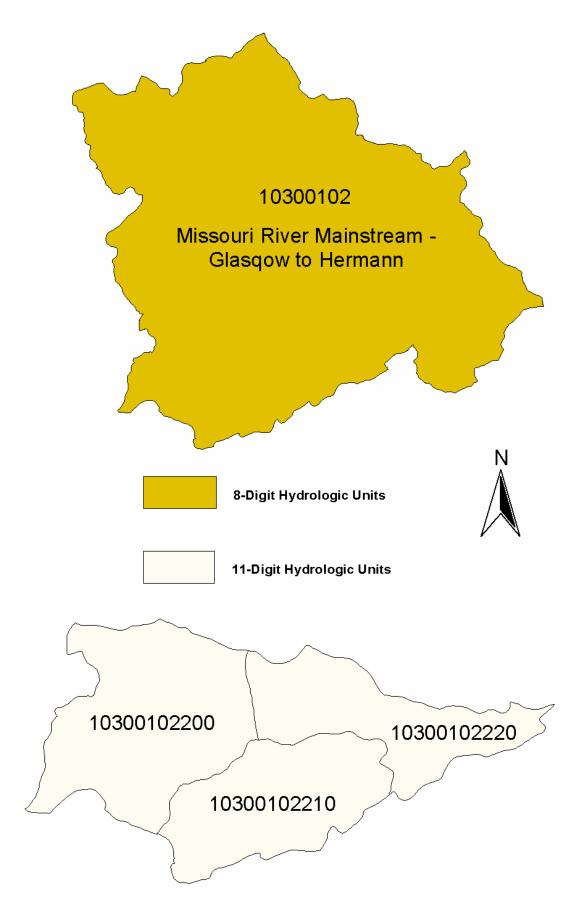


Figure wa. Hydrological units of the Moreau River Watershed.

Table 1. Watershed size and stream order of sub-basins in the Moreau River basin.

Stream Hydrologic Units	Stream Order	Unit area (sq miles)	Watershed area (sq miles)	% of Entire Watershed
North Moreau 10300102200	5	252	-	43
South Moreau 10300102210	6	174	-	30
Moreau mainstem 10300102220	6	158	-	27
Watershed sub-basin				
North Moreau	5	-	347	59
South Moreau	6	-	174	30
Moreau mainstem	6	-	63	11
Total		584	584	100

Appendix 1. Table 1. Stream lengths and order for tributaries of the Moreau River.

River Name	Stream Order	Length in miles	River mouth located on topo map named
Moreau River	6	35.2	Osage City
Coon Creek	3	3.3	Osage City
Honey Creek	3	6.5	Wardsville
UN trib-1 to Moreau R	3	2.4	Brazito
North Moreau Creek	5	47.2	Brazito/Lohman
Kautsch Branch	3	3.5	Lohman
UN trib-1 to N. Moreau Cr	3	1.6	Lohman
UN trib-2 to N. Moreau Cr	3	3.2	Lohman
Logan Creek	3	6.2	Lohman
UN trib-3 to N. Moreau Cr	3	1.2	Russellville/Lohman
Strobel Branch-1	3	4.1	Russellville
Strobel Branch-2	3	4.5	Russellville
Wieneke Branch	4	5.4	Russellville
Westing Branch	3	2.7	Russellville
Burger Creek	3	3.6	California South
Burris Fork	5	22.7	California South
Marney Branch	3	6.4	California South

Appendix 1, Table 1 continued

River Name	Stream	Length in	River mouth located
	Order	miles	on topo map named
Bear Branch	3	5.7	California South
Medlen Creek	4	6.1	California South
Colburn Branch	3	4.1	Olean
UN trib-1 to Burris Fk	3	1.6	California South
UN trib-2 to Burris Fk	3	2.0	Latham
Rocky Branch	3	2.7	Barnett
Jones Creek	4	6.7	Barnett
Gracey Creek	3	4.1	Barnett
Scott Branch	3	3.7	California South
Dry Fork	3	6.7	Clarksburg
Smith Creek	4	16.6	Latham
Pilot Branch	3	3.5	Latham
Lick Creek	3	6.7	Latham
UN trib-1 to Smith Cr	3	5.2	Fortuna
Straight Fork	4	21.2	Latham
UN trib-1 to Straight Fk	3	2.5	Fortuna
Willow Fork	4	10	Latham
Kelly Branch	3	4.3	Latham
UN trib-1 to Willow Fk	3	1.7	Latham
UN trib-2 to Willow Fk	3	3.1	Tipton
South Moreau Creek	6	37.8	Brazito
Clark Fork	4	14.2	Brazito
UN trib-1 to Clark Fk	3	1.9	Brazito
Russellville Branch	4	5.7	Brazito
Millbrook Branch	3	2.8	Brazito
UN trib-1 to S. Moreau Ck	4	2.2	Enon
UN trib-1 to UN trib-1 to S. Moreau Ck	3	1.0	Enon
Roark Branch	4	4.0	Enon
UN trib-1 to Roark Br	3	1.7	Enon
UN trib-2 to S. Moreau Cr	4	3.0	Enon
UN trib-1 to UN trib-2 to S. Moreau Ck	3	1.7	Enon
UN trib-3 to S. Moreau Ck	3	1.7	Enon
	5		
Brush Creek UN trib-1 to Brush Cr	3	9.6 2.1	Enon Enon
UN trib-2 to Brush Cr	3	1.7	
			Enon
UN trib-3 to Brush Cr	4	3.3	Enon
UN trib-1 to UN trib-3 to Brush Cr	3	1.9	Enon
UN trib-4 to Brush Cr	3	2.0	Enon
UN trib-5 to Brush Cr	4	4.6	Enon

Appendix 1, Table 1 continued

River Name	Stream Order	Length in miles	River mouth located on topo map named
UN trib-1 to UN trib-5 to Brush Cr	3	2.5	Enon
UN trub-2 to UN trib-5 to Brush Cr	3	2.1	Enon
UN trib-4 to S. Moreau Cr	3	1.7	Enon
Morgan Branch	4	3.7	Enon
UN trib-1 to Morgan Br	3	1.5	Enon
UN trib-2 to Morgan Br	4	1.9	Enon
UN trib-1 to UN trib-2 to Morgan Br	3	1.4	Enon
Rock Enon Creek	4	5.6	Enon
UN trib-1 to Rock Enon Cr	3	2.0	Olean
Blythes Creek	4	8.3	Enon
UN trib-1 to Blythes Cr	3	1.1	Enon
UN trib-5 to S. Moreau Cr	3	2.2	Olean
Beard Creek	4	3.7	Olean
UN trib-1 to Beard Cr	3	1.6	Barnett
Wilkes Creek	3	4.2	Barnett

UN=Unnamed

Appendix 1. Table 2. Summary of miles of stream frontage in the Moreau River watershed by steam order.

Order	Number of streams	Stream frontage (miles)
3	48	145
4	18	126
5	3	80
6	2	73

Figure sg. Stream gradient for the North and South Forks of the Moreau River.

